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PSEUDOJANIRIDAE (CRUSTACEA: ISOPODA), A NEW FAMILY FOR *PSEUDOJANIRA STENETRIOIDES* BARNARD, 1925, A SPECIES INTERMEDIATE BETWEEN THE ASELLOTE SUPERFAMILIES STENETRIOIDEA AND JANIROIDEA

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Abstract.—The South African marine isopod *Pseudojanira stenetrioides* is redescribed because characters of its male copulatory structures may be intermediate between the asellote superfamilies Stenetrioidea and Janiroidea. Specifically, the endopod of pleopod II has a stylet similar to that of the Janiroidea, but it lacks a sperm tube; pleopod I is similar to the stenetrioid condition but has distal stylet guides as in the Janiroidea. The female copulatory structure, the cuticular organ, is not on the anterodorsal surface as in most janiroideans, and has special auxiliary structures not described from any other asellotan. The species and genus is assigned to a new family, Pseudojaniridae, but its superfamily designation is left undecided.

Pseudojanira stenetrioides Barnard (1925) is a small isopod from South Africa, recently redescribed by Kensley (1977) and classified by that author as a member of the family Janiridae, superfamily Janiroidea. This species showed a stenetrioid habitus and male pleopods I–II that display similarities with both the Stenetrioidea and the Janiroidea (Kensley 1977: his figures 9–10). An examination of two specimens of this species from the South African Museum confirmed these observations and, in addition, revealed a new type of female genital organ. The discovery of unusual female and male copulatory organs in *Pseudojanira stenetrioides* Barnard (1925) made it necessary to prepare a redescription of this unique species. Because of the possibly transitional characters found in *P. stenetrioides,* the new family Pseudojaniridae is erected for the genus *Pseudojanira.* The superfamilial classification, however, is left undecided; proper determination of the superfamilies must be based on a complete morphological survey of all the families of the "lower" Asellota. This paper adds to and corrects information in Kensley (1977) for the purpose of providing the data on *P. stenetrioides* for such a morphological survey. A survey of asellotan female copulatory organs and other characters (manuscripts in preparation) will extend the results reported here.

Materials and Methods

M. G. van der Merwe, Marine Biology Technical Officer of the South African Museum (SAM) kindly loaned the holotype female and male specimen of *Pseudojanira stenetrioides* (catalogue numbers SAM A6295 and SAM A15345, respectively). The illustrations in this paper were inked from pencil drawings made using a Wild M20 microscope fitted with a camera lucida drawing tube. To study the reproductive organs of the female specimen, it was stained with methylene blue dissolved in lactic acid. Previous discussion of the evolution of the Asellota has typically relied on simple outline drawings of limbs for comparison. The fine details of asellotan construction, however, are often phylogenetically important

(Wägele 1983). For example, an outline of the endopod of male pleopod II would not show the difference between the stylet of *Pseudojanira* and that of the Janiroidea. Therefore, this paper will provide more pictorial information than has been typically offered in the past. In the illustrations of body parts, anterior is toward the top of the page, mouthparts and pleopods are shown in ventral view unless noted otherwise.

Order Isopoda Latreille, 1817
Suborder Asellota Latreille, 1803
Superfamily *Incertae Sedis*
Pseudojaniridae, new family
Figs. 1–3

Type genus.—*Pseudojanira* Barnard, 1925, by original designation.

Previous assignments of type.—Jaeridae: Barnard, 1925:406. Janiridae: Wolff, 1962: 252; Kensley, 1977:251. Ianiridae: Kensley, 1977:252.

Diagnosis.—Asellota with broad pereonal tergites extending laterally and ventrally, hiding coxae from dorsal view. Cephalon with dorsal eyes, broad lateral lappets, and large frontal rostrum. Pleotelson with only 1 free pleonite visible dorsally, 2 ventrally. Pereopod I robust, with enlarged setose propodus; prehension between dactylus and propodus; carpus short, quadrangular, setose, not participating in grasping. Male first pleopods with basal segments fused, distal rami separate; distolateral corners with dorsal grooves; distal margins truncate, with simple setae. Male pleopod II basal segment enlarged, with endopod and exopod projecting medially; posterior end of basal segment enlarged, thickened, with transverse distomedial groove supplied with fine setae; endopod distal segment stylet-shaped, with open ventral groove and distolateral barbs; endopod proximal segment with thickened cuticular ridge; exopod comprising only single short, robust segment, with thickened dorsal hook on setose anterodistal corner. Male pleopods I and II together not opercular. Female second pleopods (not seen by me) fused into single opercular segment lacking setae on margins. Pleopod III exopod broad, rounded, with fringe of simple setae; endopod with 3 large plumose setae; in male, exopod opercular. Uropods short, biramous, setose, barely extending beyond posterior margin of pleotelson.

Pseudojanira stenetrioides Barnard
Figs. 1–3

Pseudojanira stenetrioides Barnard, 1925: 406–407.—Kensley, 1977:251–253.

Holotype.—Adult female, 2 poorly preserved fragments (cephalon and pereon), pleotelson missing, original reported length 3 mm, width 1.3 mm, SAM 6295. Type locality: "Zululand coast, in a coral (H. W. Bell-Marley, 1920) . . ." (verbatim from original description, Barnard 1925).

Additional material.—Partially dissected adult male, with removed limbs on a slide, length (including rostrum) 2.8 mm, width at sixth pereonite 1.4 mm, SAM A15345. Locality: ". . . 24°53′S, 34°56′E, 55 metres, from fine gray sand" (verbatim from Kensley 1977).

Description (in addition to Kensley 1977).—Body characters (Fig. 1A, B): Lateral margins of pereonites oval. Body surfaces covered with fine setae. Body dorsoventrally thin but highly vaulted: tergites extending beyond main part of body and angling sharply downward. Pereonite 1 sexually dimorphic, longer and more robust in males than in females.

Female cuticular organ (Fig. 1B, 3): Described below in the section on the female copulatory organ.

Cephalon (Fig. 1A, D): Rostrum: anteriorly rounded; thin, broad, nearly as long as short antennulae; projecting anteriorly from frons, below anterior margin of cephalic dorsum. Lateral margins broad, flattened, with small anterior spine. Eyes projecting dorsolaterally from domed central

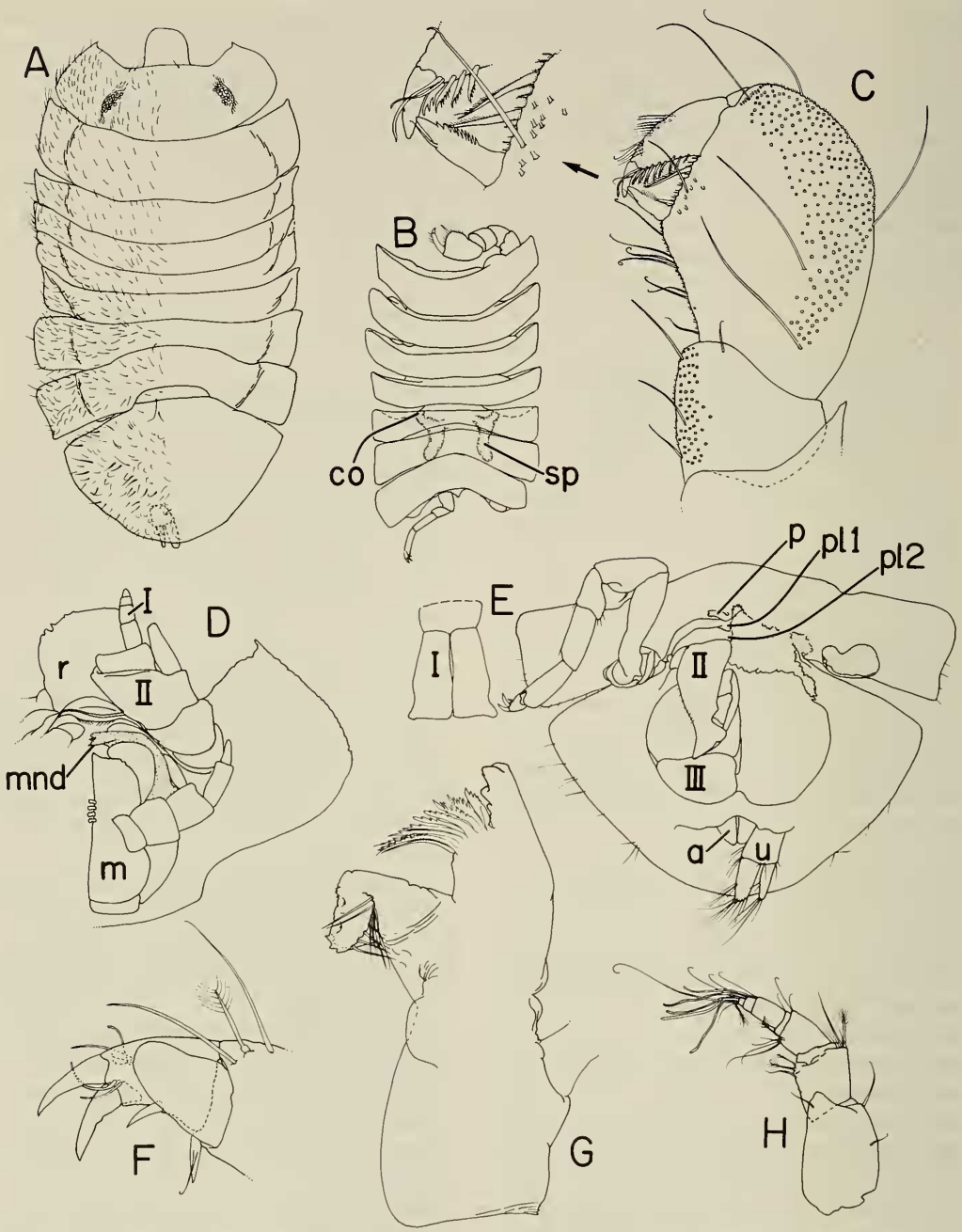

Fig. 1. *Pseudojanira stenetrioides*. A, C–H, Male, 2.8 mm; B, Holotype female, reported intact length 3 mm; A, Dorsal view, setae on right side omitted; B, Dorsal view of female pereonal fragment, co—position of cuticular organ seen through dorsal cuticle, sp—spermatheca seen through dorsal cuticle; specimen was stained in lactic acid and methylene blue to make this possible; C, Pereopod I of male, distal segments only, with enlargement of opposing setation on propodus and dactylus (carpus and propodus have many long tubular setae; setal insertions are indicated by 'u' or circular marks, and a few are drawn in to show an approximate length of the ones omitted. Some of the setae in the enlargement are illustrated in the same manner.); D, Ventral view of left side of cephalon

portion of cephalon, positioned roughly halfway between midline and lateral margins.

Pleotelson (Fig. 1A, E): Broader than long. Pleopodal cavity small, width half width of pleotelson, cavity separate from anus. Lateral margins entire, smoothly curving.

Antennula (Fig. 1H): Very short, length approximately length of antennal segments 1–4, basal segment largest. Broom setae on segments 2 and 3; aesthetascs on distal 3 segments.

Antenna (Fig. 1D): Basal segment 3 with large, basally articulated scale (or squama) extending beyond segment 4.

Right mandible (Fig. 1G): Spine row with 10 members. Articular condyle on dorsal surface distinctly shorter than length of robust molar process. Molar process with approximately 9 setae on posterior part of denticulate circumgnathal surface.

First pereopod (Fig. 1C): Claw of dactylus opposing large spine-like serrate seta on propodus. Row of small tapering setulate setae leaning toward more posterior large spine-like seta. Opposing margin of dactylus armed with row of short multiply-toothed setae. Carpus and propodus with several dense groups of long, thin setae.

Dactylar claws of walking legs (Fig. 1F): Distal tips of walking legs with 2 robust claws of similar size, and more proximal small claw-like accessory seta.

Male Pleopod I (Fig. 2A, B): Length 0.42 pleotelson length, distal segments covering rami of pleopod II. Basal segments quadrate, fused medially. Distal rami separate, distally truncate with fringe of simple setae posteriorly and laterally. Dorsal side of distolateral corners with stylet grooves (sg in Fig. 2B).

Male pleopod II (Fig. 2C, D): Length of basal segment subequal to pleopod I, with endopod and exopod inserting in center of medial margin. Basal segment distally broad, curving laterally to subacute angle, with setose groove in medial part of margin. Lateral margin of basal segment with row of simple setae. Endopod proximal segment robust, with pronounced ridge on ventromedial edge; distal segment styliform, with distally tapering groove on ventral surface and 4 small denticles on distolateral margin. Exopod robust, powerfully muscled, with rounded hook and fine setae on anterodistal edge.

Pleopod III (Fig. 2E): Exopod broad, fringed with simple setae, covering pleopods IV and V; endopod somewhat less broad, dorsal to exopod.

Pleopod IV (Fig. 2F): Endopod broader than exopod. Exopod with 2 free, laterally rounded segments, and 7 plumose setae on distal tip.

Pleopod V (Fig. 2G): Endopod longer and broader than endopod of pleopod IV. Basal segment and endopod fused, exopod absent.

Discussion

Characters important to the classification of the Asellota.—Because the current classification of the superfamilies of the Asellota is based on the pleopods (Wolff 1962), the unique combination of the male pleopod characters (Fig. 2A–D) in *Pseudojanira stenetrioides* make it difficult to place in the accepted superfamilies. I will not discuss all the superfamilies here because the Pseu-

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(right side had been dissected); I—antennula, II—antenna, r—rostrum, m—maxilliped, mnd—mandible; note how the rostrum is nearly as long as the antennula, the tip of which is protruding past the basal articles of the antenna; E, Ventral view of male pereonite 7 and pleotelson, with pleopod I shown at the same scale; I—pleopod I, II—pleopod II, III—pleopod III, p—penile papillae, pl.1—presumed pleonite 1, pl.2—presumed pleonite 2, a—anus, u—uropod; F, Dactylus of pereopod mounted on slide, possibly pereopod VII as in Kensley (1977); note presence of 2 subequal claws and a more proximal accessory seta on dactylus; G, Right mandible, dorsal view, palp omitted; H, Right antennula, ventral view.

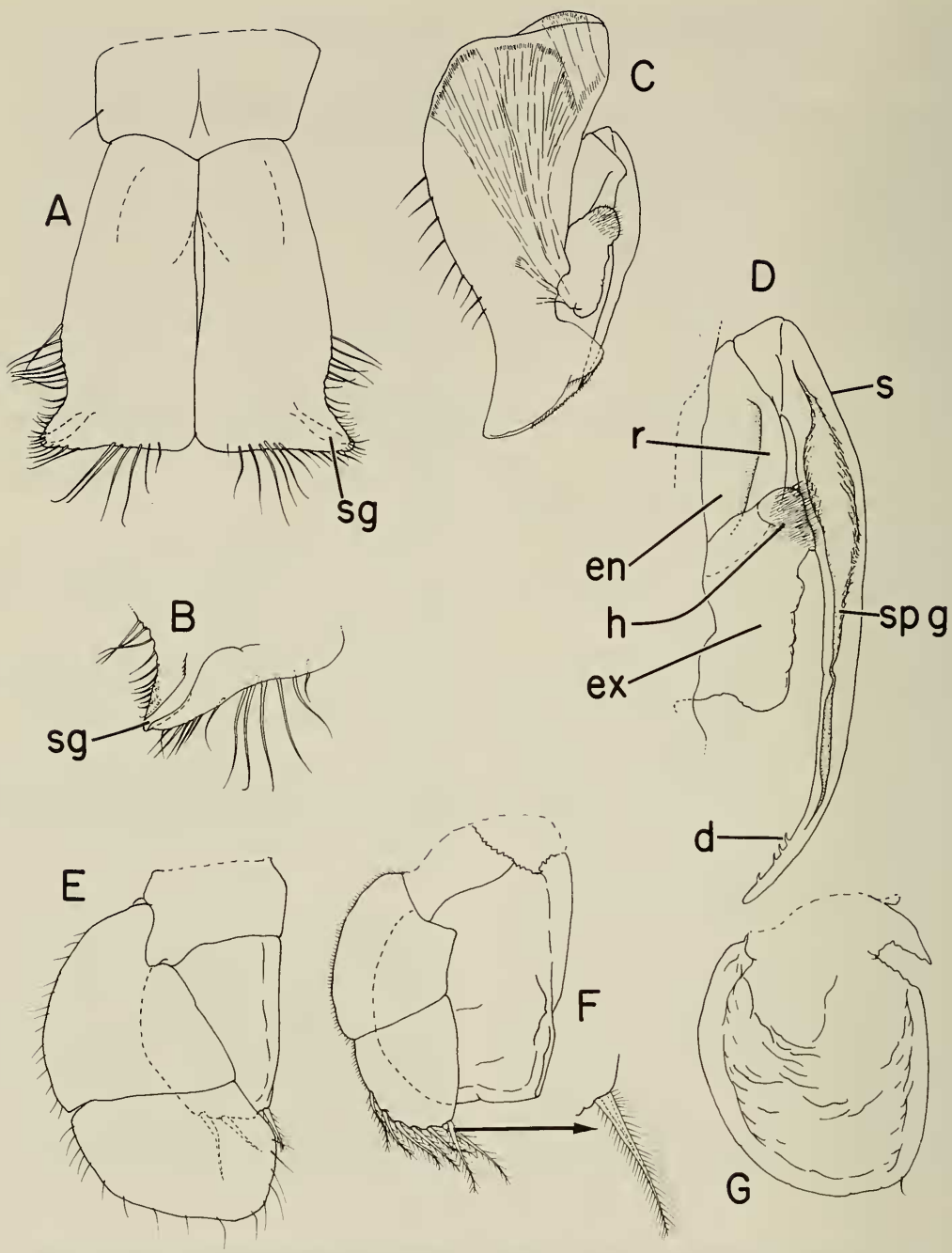

Fig. 2. *Pseudojanira stenetrioides.* Dissected parts on slide from male paralectotype. A, Pleopod I, ventral view; B, Pleopod I, dorsal (interior) view of distolateral corner; sg—stylet groove; C, Pleopod II, ventral view, exopodal musculature shown through cuticle; D, Pleopod II rami, d—denticles, en—endopod, ex—exopod, h—position of dorsally directed hook on exopod, r—ridge on proximal segment of endopod, s—stylet (distal segment of endopod), spg—sperm groove (note the ridge on proximal segment of the endopod; if homologous to the janiroidean condition, this ridge may allow the well-muscled exopod to hook onto the endopod during copulation); E–G, Pleopods III–V respectively, plumose seta on pleopod IV enlarged.

dojaniridae, the Stenetrioidea, and the Janiroidea will be shown in another paper to form a monophyletic group in exclusion to all the other asellote taxa. The primary synapomorphies of this group are a short, single-articled exopod of male pleopod II and a cephalon with a frontal projection. The following discussion is nonphylogenetic and is only meant to highlight the intermediate nature of *Pseudojanira.* The unique female copulatory organs, also of taxonomic significance, are described below.

The first male pleopod of *Pseudojanira* has a mixture of janiroidean and stenetrioid characters. As in *Stenetrium,* the basal segment is large, quadrate, and medially fused. The two sides of the distal segment are free from each other. In contrast, all janiroideans have highly reduced basal segments of the male pleopods I and their distal rami are medially fused forming a central sperm tube. However, the distal tips of the first pleopod in *Pseudojanira* are setose, and their distolateral corners have deep, laterally-curving grooves on the dorsal surfaces, homologous to the same structures in the Janiroidea that function as guides for the stylet of the second pleopod. This determination of homology is made on the basis of the position and presumed functional relationships of the stylets in both taxa.

The male second pleopod is interesting not only in its similarity to the janiroidean condition, but also for specializations that are seen only in this species. Derived characters shared with the Janiroidea are the pointed endopodal stylet, the ridge on the proximal segment of the endopod, and the club-like and hooked form of the exopod with its enlarged musculature and distal group of fine setae. The stenetrioid endopod is club-shaped and lacks the proximal coupling groove, and the exopod, although short, is not stout and hooked. Unlike any janiroidean, however, the stylet of *Pseudojanira* has only a ventral groove and terminates with tiny barbs. The distal end of the basal segment is also unusual and does not occur in either the Stenetrioidea or the Janiroidea: it narrows just posterior to the exopod, and then becomes broad more distally. The distal end is curved, grooved, and covered with tiny, fine setae. The distal part of the stylet rests in the groove of the basal segment's tip. It may function as an auxiliary stylet guide, or perhaps as the top part of an enclosed sperm channel.

The diagnosis (above) of the Pseudojaniridae states that one free pleonite is visible dorsally (Fig. 1A), and two ventrally (Fig. 1E). This observation is made with some misgivings because the only whole specimen had been damaged by Kensley's dissection in the region of the ventral pleonites. If more specimens come to light, the pleonites should be re-examined. If this observation is correct, *Pseudojanira* possesses another intermediate character between the Janiroidea (1 free pleonite) and the Stenetrioidea (2 free pleonites, 1 reduced). I agree, however, with Fresi et al. (1980) that the number and fusion of free pleonites is less important than other characters in the classification, simply because the reduction of characters may recur independently, without apparent differences in unrelated taxa.

The chaetotaxy and form of the first pereopod require special mention: in many respects, both features are similar to those of *Stenetrium.* The typical janiroidean first pereopod has fewer setae, a larger carpus, and a smaller propodus. Wägele (1983) makes a strong case for the similarity of the chaetotaxy of the Stenasellidae, Atlantasellidae, and Microcerberidae of the superfamily Aselloidea (see his figure 1, p. 253), asserting that the microcerberids belong in the Aselloidea based on these similarities. Although I don't doubt his overall conclusions on the placement of the Microcerberidae, these setal similarities may be primitive characters at the level of the Asellota, because many of the same types of setae are also seen in *Pseudojanira, Stenetrium,* and *Gnathostenetroides,* all "out groups" to the Aselloidea.

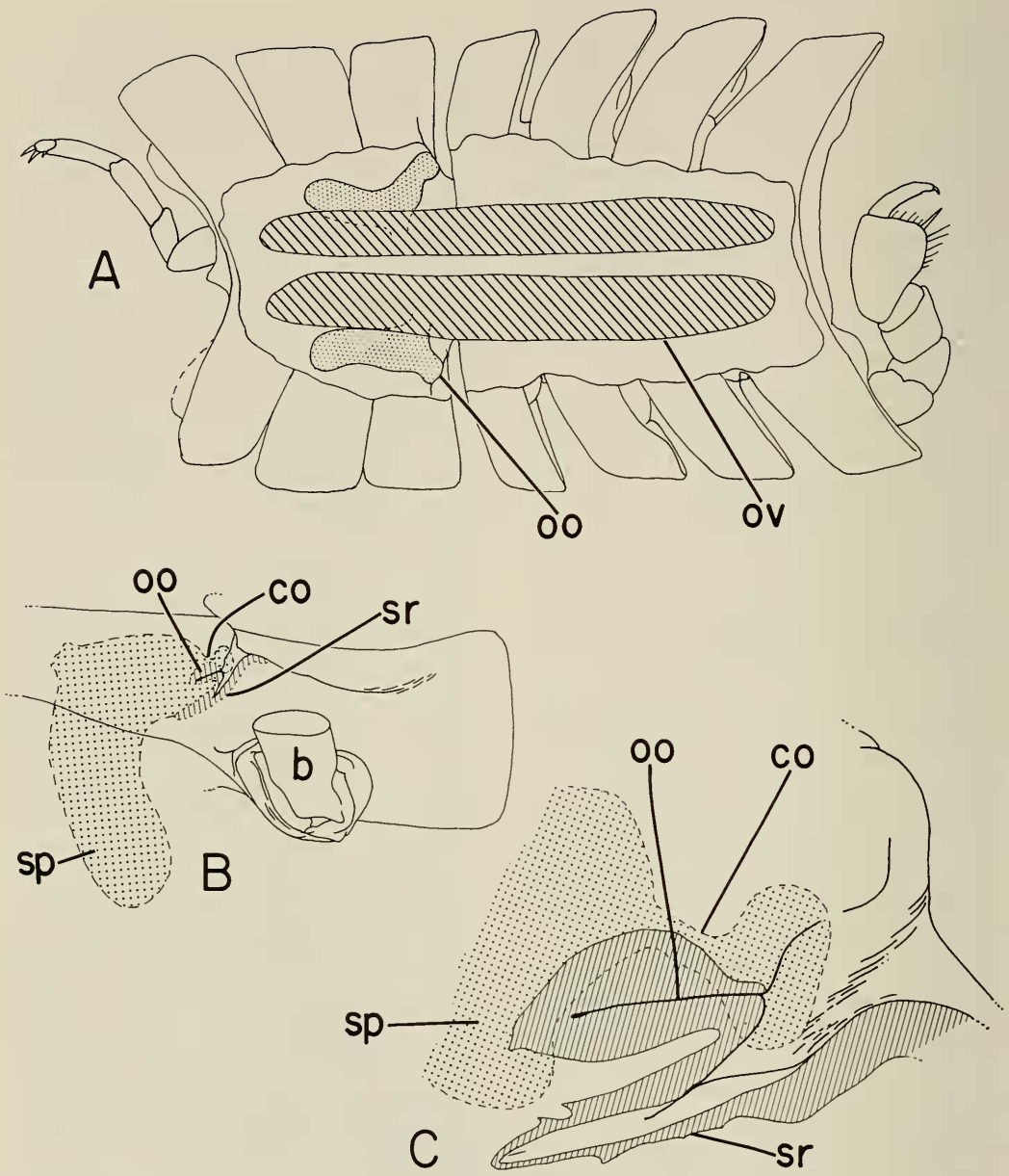

Fig. 3. Female reproductive system of *Pseudojanira,* preparatory female. A, Semi–diagrammatic dorsal view of the reproductive organs, showing what they would look like if the dorsal surface of the pereon were removed (anterior is to the right, cephalon and pleotelson broken off); B, Ventral view of pereonite 5, left side, showing oopore region and spermatheca through the ventral surface; C, Enlargement of oopore region showing structures beneath the cuticle, ov—ovary, oo—oopore, co—cuticular organ, sp—spermatheca, sr—stylet receptacle, b—basis of pereopod V truncated (shown only partially).

The accessory seta on the dactyli of pereopods II–VII is close in position to the third accessory claw found in the janiroidean family Janiridae and also in the Protojaniridae, and is nearly identical in position to an accessory seta on the dactyl of the Stenasellidae (see Magniez 1974:33). This seta is presumed to be homologous to the

third "claw" of the Janiridae, and could well be common to all of the Asellota.

The female copulatory organ.—Because only the preparatory female holotype of *Pseudojanira stenetrioides* was available, no specimens were macerated in potassium hydroxide (a useful technique for studying cuticular structures). The female did stain well in lactic acid and methylene blue, allowing inspection of the cuticular organ (see Veuille 1978 for a description of the homologous structure in *Jaera*) close to the ventral surface. The cuticular organ opens on the anterior edge of the attachment of the oviduct to the ventral cuticle, and is adjacent to a cuticular fold that continues posteriorly into a blind tube just below the ventral surface. This closed tube opens anteriorly to a broad groove in the anteroventral edge of the fifth pereonite that curves dorsally. The opening of the cuticular organ is surrounded by a bulbous, thickened funnel that appears to open almost directly into a large spermathecal sac. The cuticular organ is also positioned anterior to the oopore and is almost separate from it. The spermatheca protrudes posteriorly into the sixth pereonite and was observed to contain translucent, heavily staining material similar to sperm masses seen in other species of Asellota. A pocket-like structure protrudes internally and dorsally from the external position of the oopore.

The systematic position of Pseudojanira.—Much of the unusual nature of *P. stenetrioides* derives from its possession of unique characters or characters seemingly intermediate between two superfamilies of the Asellota. This taxon is assigned to the Pseudojaniridae n. fam. because it cannot be effectively placed in any of the existing asellote families without diluting the potential recipient family's or superfamily's concept. Moreover, *Pseudojanira* has reproductive specializations that are unique to the Asellota, thereby warranting the new family for the genus. Its higher classification, however, can be stated no more accurately than "Isopoda Asellota superfamily *incertae sedis.*" Conceivably a new superfamily could be created as well, but this would result in continued 'superfamily inflation' with the perceived differences between the superfamilies becoming smaller and more difficult to reconcile. Note, for example, Schultz's (1978) ill-fated (Sket 1979; Wilson 1980) attempt to create a new asellotan superfamily based on the presence of a free coxa on the first pereopod.

The male pleopods I and II define the superfamily Janiroidea extremely well: all the diverse members of that taxon have male copulatory structures identical in their general form. The homologous structures in all the remaining families of the Asellota, on the other hand, show radical variations, with differences in the endopod of male pleopod II often characterizing species and genera, rather than superfamilies (e.g. species of the asellid genus *Caecidotea,* Lewis and Bowman 1981; genera of the Stenasellidae, Magniez 1974, his figure 11). This variation heralds a need for a re-evaluation of the current classification. Describing the second pleopod's endopod of the janiroidean male as "stylet-like" provides insufficient data because the detailed structure of the stylet is different between the Janiroidea, the Pseudojaniridae, and the Protojaniridae (Fresi et al. 1980). More morphological data must be collected on all the major groups of the Asellota to allow effective comparisons. A study of the female copulatory organs may be of considerable value, but other features require attention. *Pseudojanira stenetrioides* will provide a useful datum in this evolutionary discourse.

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